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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/212,726	12/15/1998	KLAUS F. SCHUEGRAF	M122-1098	7984

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EXAMINER	
KIELIN, ERIK J	

ART UNIT	PAPER NUMBER
2813	18

DATE MAILED: 04/19/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/212,726	Applicant(s) SCHUEGRAF, KLAUS F.
	Examiner Erik Kielin	Art Unit 2813

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *07 March 2002* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *39,41 and 44-52* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *39,41 and 44-52* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 7 March 2002 has been entered.

Information Disclosure Statement

2. The information disclosure statement filed 12/15/98 fails to comply with 37 CFR 1.98(a)(3) because it does not include a concise explanation of the relevance, as it is presently understood by the individual designated in 37 CFR 1.56(c) most knowledgeable about the content of the information, of each patent listed that is not in the English language. It has been placed in the application file, but the information referred to therein has not been considered.

This is being repeated because Applicant was non-responsive.

Claim Objections

3. Claim 41 is objected to because of the following informalities: presently, claim 41 depends from canceled claim 40. For the purposes of patentability, Examiner assumes that Applicant meant to amend claim 41 to depend from independent claim 39, from which canceled claim 40 depended. Appropriate correction is required.

Claim Rejections - 35 USC § 112

4. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

5. Claims 48 and 52 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

Claims 48 and 52 require "conditions which are effective to... reduce the theoretical decomposition rate [of the organic silicon precursor] to a lower actual decomposition rate." In short, addition of either H_2O or H_2O_2 speed up or do not affect the decomposition rate of the organic silicon precursor; they do not reduce the decomposition rate, as explained in more detail below.

Examiner respectfully submits that the only provision for reducing the decomposition rate provided in the specification is an *incorrect* application of Le Chatelier's Principle which can be found beginning on page 9, line 20. The information regarding the theory is incorrect for at least the following reasons: (1) The organic silicon precursor is *not in equilibrium* with the at least one of H_2O or H_2O_2 because both intermediate and product compounds of silicon are being removed from the system by deposition onto the substrate which, according to the aforementioned theory, *speeds up rather than reduces* the decomposition of the precursor. (See, for example, Applicant's admitted prior art article by IslamRaja et al., page 722, last paragraph, right-hand column.) (2) There is *no reverse reaction*, so an equilibrium cannot exist. Instead,

each of the organic silicon precursors claimed by Applicant can only produce H_2O by reaction of the organic portion only, the reverse reaction is thermodynamically prohibited under the conditions presented by Applicant. (3) Assuming *arguendo* that H_2O or H_2O_2 were somehow in equilibrium with the organic silicon precursor, as both a reactant and a product, H_2O or H_2O_2 would tend to cancel each other out in effect of shifting equilibrium. As more H_2O (or H_2O_2) would be produced, more reactant and product would be introduced which would tend to cancel in effect to a degree determined by the stoichiometry of the reaction. Without a specific precursor, it is impossible to determine such stoichiometry and therefore impossible to determine the alleged degree of reduction -- again assuming arguendo such equilibrium exists.

Examiner acknowledges the well known fact that H_2O (or H_2O_2) is a product of the *net* or *global* reaction in the decomposition of the organic silicon precursors (IslamRaja et al. page 722, equation (1) and paragraph thereafter) but H_2O (or H_2O_2) is **not** in equilibrium with the precursor and therefore cannot reduce the rate as alleged by Applicant in the specification. Consequently one of ordinary skill would find either *no change* in the decomposition rate or more likely an *increase* in decomposition rate of the organic silicon precursor as found, for example, by **Sukharev** (US 5,710,079; column 3, line 66 to column 4, line 13; paragraph bridging cols. 6-7; col. 7, lines 13-28; col. 8, lines 20-31) for tetraethylorthosilicate (TEOS) and other organic silicon precursors. Absent evidence to the contrary, the method as claimed would not operate as alleged.

Further in this regard, US 6,352,338 B1 (**Komuro**), as will be presented below, discloses a method of depositing SiO_2 from TEOS and water, wherein the water is varied within a range of from 9% to 60% of the total reactants in the gas mixture. (See col. 9, Table 1.) The data

presented in Table 1 of **Komuro** shows that the rate of decomposition of the TEOS and OMCTS is *completely unaffected by the addition of water* in amounts of 9% to 60% H_2O --the range overlapping that range indicated by Applicant to decrease the decomposition rate of TEOS, less than 0.5% to 50%. (See Applicant's specification, pages 10 and 12). This is actual experimental data, which would supercede theoretical speculation.

Since Applicant indicates that they have observed a decrease in the rate (section entitled "Remarks" section of Paper No. 7, page 4, lines 9-10), **Applicant could overcome the rejection simply by providing a signed affidavit with the appropriate experimental data showing such decrease in rate in fact occurs.** This should not provide a burden since Applicant indicates that such data already exists. This evidence is especially necessary since the preponderance of evidence (all of the evidence) indicates that (1) Applicant's theory regarding the decomposition rate, upon which claims 48 and 52 are based, is flawed, and (2) all present evidence of record indicates that the addition of either of water and hydrogen peroxide *increases* or *does not change* the decomposition rate of the TEOS, rather than increase the decomposition rate of TEOS. See section entitled, "***Response to Arguments***" for further reasoning.

6. Claims **39**, 41, 44-46 and **47** and **48**-52 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

While Examiner acknowledges that Applicant has indicated (in Paper No. 16, p. 11, first full paragraph) that there exists support for the limitation of "in the absence of an external source

of ozone" to be in Applicant's specification at "for example, page 9, lines 3-15; page 11, lines 11-17, and page 11, line 22 through page 12, lines 3-23," Examiner can find no indication or support or reasoning to exclude ozone or for the negative limitation now recited. Examiner notes with interest, in this regard, that Sukharev employs ozone.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. Claims **39**, 41, 44 and **47**, 49 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Sukharev** (US 5,710,079).

Sukharev discloses a method of depositing SiO_2 on a substrate using a H_2O/H_2O_2 CVD process in which an organic silicon precursor (for example, TEOS, and others as in claim 7) and H_2O and/or H_2O_2 are fed separately into a CVD reactor (col. 5, lines 55-65) in a concentration of 0.5 to 6 percent (col. 7, last paragraph). The H_2O may be introduced without H_2O_2 (col. 6, line 55). (See also cols. 3-7; Figs 2-3.)

Because the concentration range indicated by Applicant in the specification provide conditions "which are effective to reduce formation of undesired reaction intermediates" (see specification page 12, lines 3-13) and overlap those in **Sukharev**, the method of **Sukharev** must inherently reduce the formation of undesired reaction intermediates. (See MPEP 2112.)

Although **Sukharev** does not specifically indicate that the presence of H_2O and/or H_2O_2 decreases undesired reaction intermediates, **Sukharev** does indicate that the growing SiO_2 film has reduced carbon resulting which is an intermediate in the decomposition of the organic moieties of TEOS. It is held, absent evidence to the contrary, that the method of **Sukharev** will inherently reduce the presence of unwanted reaction intermediates.

Regarding claim 41, the prior art as explained above discloses all of the limitations of the instant invention, but does not teach Applicant's concentration range of 5-15%. Instead, **Sukharev** discloses ranges of 0.5 to 3% H_2O and 0-3% H_2O_2. However, it has been held that choosing parameters within or near ranges taught by the prior art is *prima facie* obvious. See *In re Wertheim,* 541 F.2d 257, 191 USPQ 90 (CCPA 1976). See also *In re Huang*, 40 USPQ2d 1685, 1688(Fed. Cir. 1996)(claimed ranges of a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). Therefore, it would have been obvious to choose a concentration with Applicant's range because Sukharev discloses the overlapping range of a combination of H_2O and H_2O_2 of 0.5-6%, according to the precedent set by *In re Wertheim or In re Huang*. Also, one would be motivated to add 5-15% in order to further increase that rate of deposition and thereby increase manufacturing throughput, which is always highly desired in the semiconductor manufacturing art.

Further in this regard, since Applicant clearly teaches that any amount of water less than 50% down to less than 0.5% (specification page 10 and page 12) is sufficient to attain Applicant's observed reduction in undesired reaction intermediates, it is unclear how 5% to 15% could produce unexpected results. Nonetheless, no evidence has been provided by Applicant.

Regarding the apparatus limitations --specifically the type of reaction chamber in which the deposition is carried out-- if it is thought that the apparatus limitations have patentable weight, then this may be a difference. But it has been held that to be entitled to weight in method claims, the recited structure limitations therein must affect the method in a manipulative sense, and not amount to the mere claiming of a use of a particular structure. *Ex parte Pfeiffer*, 1962, C.D. 408 (1961). In this regard then, the carrying out of the deposition in a low-pressure, hot-wall, cold-wall, or combinations thereof, CVD chamber, has no patentable weight in the method claims because none of said limitations are manipulative of the method.

9. Claims 45, 50, and **48**, 52 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Sukharev**, in view of **Wolf** et al. Silicon Processing for the VLSI Era, Vol. 1-Process Technology, Lattice Press: Sunset Beach CA, 1986, pp. 169, 171.

Sukharev teaches each of the features of the instant invention except (1) the presently claimed pressure ranges over which the SiO_2 is deposited and (2) the specific apparatus limitations. **Sukharev** does, however state that, "Fig. 3 is a diagrammatic illustration of an atmospheric pressure chemical vapor deposition (APCVD) reaction chamber 300 in accordance with **one embodiment** of the present invention." (Emphasis added; col. 5, lines 44-47.)

Regarding claims 45, 48, and 50, (low-pressure, hot-wall CVD reactor at pressures of 100 mTorr to 3 Torr), **Wolf** teaches that hot-wall, **low-pressure** CVD reactors are the most widely used reactors and are employed for depositing silicon oxide films because of their superior economy, throughput, uniformity, and ability to accommodate large diameter wafers on page 169, last 8 lines). **Wolf** also teaches that typical pressures for low pressure CVD within a hot-

wall reactor are 0.25 Torr (250 mTorr) to 2.0 Torr, which falls within the instantly claimed range. (See pp. 169-170).

It would have been obvious to one of ordinary skill in the art at the time of the invention to apply the teachings of **Wolf** to **Sukharev** for the reasons given by **Wolf**, and also because it appears that the temperature of the wall of the CVD reactor, whether "hot" or "cold," and the pressure within the reactor have absolutely no impact on the decomposition rate of the organic silicon precursor.

10. Claims **39**, 41, 44-45 and **47**, 49, 50 and **48**, 52 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Komuro** (US 6,352,338 B1).

Komuro discloses a method of depositing SiO_2 on a substrate using a low pressure CVD reactor in which an organic silicon precursor (for example, TEOS or OMCTS, and others as in claim 7 of Komuro) and H_2O are fed separately into a low pressure CVD reactor and wherein the pressure is 1 Torr. (See Table 1, Example Nos. 1.1-1.5 and 2.1-2-5.) Note that the water varies in concentration from 9% to 60% percent (column 9, Table 1).

Although **Komuro** shows that the rate of decomposition of the TEOS and OMCTS is completely unaffected by the addition of water in amounts of 9% to 60% H_2O --the range overlapping that range indicated by Applicant to decrease the decomposition rate of TEOS, less than 0.5% to 50% [Applicant's specification, pages 10 and 12]-- it is held absent evidence to the contrary, that the rate is inherently "decreased" because the method of **Komuro** uses the same claimed and disclosed method as does Applicant. It is also held, absent evidence to the contrary, that "undesired reaction intermediates on the organic silicon precursor which form at higher

topological elevations on the substrate than would otherwise occur without the feeding of the at least one of H_2O and H_2O_2" because, again, the method in **Komuro** is the same as disclosed and claimed by Applicant. (See MPEP 2112.)

Regarding claims 45, 48, and 50, the apparatus limitations --specifically the type of reaction chamber in which the deposition is carried out-- if it is thought that the apparatus limitations have patentable weight, then this may be a difference. But it has been held that to be entitled to weight in method claims, the recited structure limitations therein must affect the method in a manipulative sense, and not amount to the mere claiming of a use of a particular structure. *Ex parte Pfeiffer*, 1962, C.D. 408 (1961). In this regard then, the carrying out of the deposition in a hot-wall, or cold-wall, low pressure CVD chamber, has no patentable weight in the method claims because none of said limitations are manipulative of the method.

11. Claims **39**, 41, 44, 46, and **47**, 49, 51 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Muroyama** (US 5,470,800).

Muroyama discloses a method of depositing SiO_2 on a substrate using a low pressure CVD reactor in which an organic silicon precursor (col. 3, lines 23-43) and H_2O are fed separately into a low pressure CVD reactor (Figs. 1-3) and wherein the pressure is 10 Torr. Note that the water, in an exemplary embodiment (at col. 4, lines 53-59) teaches the concentration of H_2O of 25% of the total flow into the reaction chamber.

Muroyama also discloses an embodiment wherein the concentration of H_2O of 25% of the total flow into the reaction chamber is 1.31% (col. 6, lines 15-21). **Muroyama** goes on to say, regarding this embodiment that the TEOS/H_2O ratio may be regulated in the range of 10/1 to

100/1. Given these ratios, the water concentration may be about 5%, which touches the claimed concentration of water in claim 41.

Because the concentration range indicated by Applicant in the specification provide conditions "which are effective to reduce formation of undesired reaction intermediates" (see specification page 12, lines 3-13) and overlap those in **Muroyama**, the method of **Muroyama** must inherently reduce the formation of undesired reaction intermediates. (See MPEP 2112.)

Regarding claims 46 and 51, the apparatus limitations --specifically the type of reaction chamber in which the deposition is carried out-- if it is thought that the apparatus limitations have patentable weight, then this may be a difference. But it has been held that to be entitled to weight in method claims, the recited structure limitations therein must affect the method in a manipulative sense, and not amount to the mere claiming of a use of a particular structure. *Ex parte Pfeiffer*, 1962, C.D. 408 (1961). In this regard then, the carrying out of the deposition in a hot-wall, or cold-wall, low pressure CVD chamber, has no patentable weight in the method claims because none of said limitations are manipulative of the method.

Response to Arguments

12. Applicant's arguments filed 7 March 2002 have been fully considered but they are not persuasive.

Applicant's arguments regarding the rejection of the claims under 35 USC 112(1) as lacking enablement are not persuasive. Applicant has only selectively argued the rejection. In short, whether or not equilibrium exists, does not change the fact that all of the evidence of record indicates that either or both water and hydrogen peroxide accelerate or do not affect the

decomposition rate of TEOS over Applicant's claimed pressure and water and/or hydrogen peroxide concentrations.

Applicant has made selective arguments regarding the IslamRaja reference --a reference *provided by Applicant* to rebut the same rejection under 35 USC 112(1) in an earlier action. Applicant now suggests that the reference --which Applicant provided-- is somehow incorrect because Examiner pointed out that it supports the position that water would likely *increase*, rather than decrease, the decomposition of TEOS. Applicant has selectively argued, on the basis of the newly submitted reference article by Coltrin et al., that a theoretical equilibrium may exist. This line of reasoning fails to address the argument forwarded by Examiner that the IslamRaja reference supported the position that the decomposition rate of TEOS is first order --therefore directly proportional-- in the concentration of water --not of some negative order with respect to water. Instead Applicant has provided a different reference which presents **absolutely no support** for a decrease in the rate of decomposition of the TEOS. Accordingly, Applicant's arguments in the regard are incomplete and moot, as not addressing the most salient portion of the argument: that the reaction rate does not decrease in the presence of water.

Further in regard to the Coltrin reference, Examiner notes that Applicant's specification makes clear that the deposition is via plasma-enhance CVD, not thermal CVD, as presented in Coltrin. As is well known in the art, a plasma has a high concentration of highly reactive ions and radicals. Due to the presence of the highly reactive ions and radials, the "equilibrium" would necessarily be different than in the thermal CVD. Accordingly, the Coltrin reference is not relevant to alleged equilibrium in a plasma CVD method.

The remainder of the arguments are moot because they are directed to new matter introduced into the claims by the latest amendment. Furthermore, the applied references of Komuro and Muroyama each teach deposition without ozone.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Erik Kielin whose telephone number is 703-306-5980. The examiner can normally be reached on 9:00 - 19:30 on Monday through Thursday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached at 703-306-2417. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9318 for regular communications and 703-872-9319 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

Erik Kielin
April 16, 2002